

**TEXTILE AND FOOTWEAR PRODUCTS TREATED WITH SULFUR**

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**DESCRIPTION****Field of the invention**

The present invention relates to the use of a substance capable of completely eliminating the bad smell of the feet, in particular but not exclusively when applied to socks, stockings and footwear products. It therefore extends also to textile, footwear or sanitary products treated with said substance.

**Description of the prior art**

It is well known that our feet can emanate bad smell when we take off our footwear, especially after it has been worn for an entire day. This phenomenon is even more perceptible when the used shoes are made of rubber or, in any case, synthetic material that prevents transpiration. After a certain period of use, the shoe tends to become impregnated with that smell and thus tends to become a bad-smell source of its own.

At present there does not exist any truly effective remedy for this bothersome inconvenience. Indeed, the few products available on the market today manage to procure only a slight attenuation of the bad smell, so that one cannot really appreciate any significant improvement deriving from the use of these products. The bad-smell problem of the feet has therefore remained without a solution to this day.

Various studies carried out in this connection have shown that the bad smell emitted by the feet is due to a particular type of fungus, known as *Tinea pedis*, that

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proliferates in anaerobic environments, finding in particular an optimal habitat, at body temperature, in the interstices between the third, fourth and fifth toe. In fact, this is the least exposed and aired area of the feet, where it takes root and resists the humidity deriving from both the sweating and the washing of the same feet.

The degree of humidity, and consequently also the proliferation of the fungus and the bad smell to which it gives rise, obviously augments as the sweating increases. The intensity of the sweating is bound up not only with the individual predisposition, but obviously also the type of shoe that is being worn. It is well known that sport shoes tend to hinder transpiration, and the particularly abundant sweating that derives there from, together with the anaerobic environment and the temperature conditions (equal to about 37°C, i.e. the body temperature), render the situation particularly favorable for the proliferation of *Tinea pedis*.

#### 20      Summary of the invention

The applicant has now found out a fully effective solution of the problems outlined above thanks to the identification of an active principle capable of completely inhibiting the proliferation of this fungus and therefore also of wholly eliminating the bad smell due to the sweating of the feet.

According to the invention, the substance capable of inhibiting the bad smell of the feet is constituted by elementary sulphur, preferably in the micronized state. In this form it is preferably applied to socks, stockings or any other textile or footwear product intended to come into - direct or indirect - contact with the part that is

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to be deodorized. To this end the active principle is combined with other substances with a view to realizing a stable fixing to the support, assuring a persistent release of the active principle in the course of time, and  
5 this even after a succession of washings.

Socks treated in the manner just described render the feet free of bad smell, even after a toilsome day during which use has been made of sport shoes. Experimental tests carried out on persons particularly  
10 prone to this kind of problem, who for this purpose were made to wear treated socks, demonstrated the complete disappearance of the bad smell. Moreover, repeated washings of the socks did not bring out any perceptible decay of the deodorizing properties. No allergic  
15 manifestation of any kind to the detriment of the wearers were revealed by any of the tests.

#### Description of preferred embodiments

The characteristics and advantages of the present invention will be brought out more clearly by the  
20 following description of its embodiments, which is given purely by way of example and is not to be taken as limitative in any way.

As already suggested above, the invention finds its most fruitful practical application - though not the only  
25 one - in the preparation of a deodorizing composition to be used for treating the article destined to come into - direct or indirect - contact with the foot, and therefore socks, stockings, insoles, but also soles and uppers of shoes, in order to obtain footwear articles that do not  
30 acquire an unpleasant smell during their use. In all these cases the treatment will preferably be carried out by the producer of the article before it is brought into commerce

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and even, in the case of soles, uppers or other parts of shoes, before or during the actual manufacture of the shoe.

A simple example of a deodorizing composition for  
5 applying the active principle to socks consists of an aqueous solution containing the following:

- 0.2 ÷ 0.3 g/l of wettable elementary sulphur (active principle), preferably micronized;
- 10 ÷ 20 g/l of resin, silicon resin for example;
- 10 - 10 ÷ 20 g/l of a cationic surfactant, a common fixative for dyes for example;
- 2 ÷ 5 g/l of softener, a perfumed Henkel® softener for example.

The socks to be treated are immersed for a few  
15 minutes in the bath prepared in this manner, which is brought to a temperature of about 40°C when a fibrous material containing wool is involved, or to about 90°C in the case of other materials. The treatment time and temperature, but also the formulation of the composition,  
20 may however be varied according to the particular machine employed. The indications provided above are considered to be optimal in the case of treatment with, for example, a centrifugal washing machine. The treatment is completed with a brief phase of rinsing, drying and centrifuging,  
25 this once again at a temperature that may be varied according to the type of textile fiber. Moreover, the aqueous bath may be replaced by a phase in which the composition is sprayed directly onto the articles by means of ejection devices of a known type.

30 Alternatively, the active principle may also be applied prior to the actual manufacturing of the articles of clothing, i.e. to the fabrics from which these articles

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are to be made. This can be done, for example, in a continuous operating modality by carrying out the impregnation in a foulard machine with a bath containing 5 + 10 g/l of the active principle in emulsified form with a non-ionic surfactant, 3 + 5 g/l of emulsified acrylic resin, in a pH made slightly acid by means of acetic acid (pH=5) in case of wool-based fabrics, or in a neutral pH in case of fabrics with a cellulose base. Following wringing, the fabric is dried in a "Rameuse" machine at a temperature of at least about 150°C, which is necessary to assure the polymerization of the acrylic resin.

In the compositions suggested above the resin obviously has the fundamental function of fixing the active principle to the textile fiber, holding the principle and thus making it resistant to subsequent washings. Being in the micronized state, the sulphur is released very slowly, thus assuring its deodorizing action in the course of time. Neither the silicon resin nor the acrylic resin causes any appreciable alteration of the softness characteristics of the fiber and they are therefore particularly suitable for this purpose. Other types of resins may however be used - resins with a butadiene base being a case in point - even combined in appropriate proportions.

In case of materials with a woolen base it is preferable to use resins capable of being polymerized at low temperatures, like those with radical-type polymerization mechanisms. In any case, the softener may serve to attenuate a possible stiffening effect deriving from the presence of the resin. The surfactant obviously contributes to increasing the fixing power of the sulphur to the fibrous material.

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Application to textile fibers, for example and typically in accordance with the modalities described above, represents a particularly advantageous reduction to practice of the invention, because it assures an optimal effectiveness of the deodorizing action without in any way altering either the appearance or the original softness of the supporting materials, which will also remain wholly free of smell. However, this application can be carried out with various modalities, especially in accordance with the variations of the material for which it is intended and therefore also of the machines that are employed. For example, the latter could include the so-called "Dutch machines", where the movement of the bath is more gentle and thus avoids the physical alteration of materials made of wool fibers.

As already mentioned, another possible advantageous use of the invention envisages the application of a sulphur-based composition directly to shoes, in particular by treating in accordance with one of the above-described modalities the textile lining of an insole intended to come into contact with the foot. Either alternatively or in addition thereto, the elementary sulphur could be mixed with the glue employed for fixing the textile lining to the base material (generally a polyurethane) of the insole.

In the generically sanitary field, a deodorizing cream for local use can be obtained by amalgamating the elementary sulphur, or a substance with an elementary sulphur base, with vaseline or lanoline in proportions appropriate for obtaining the required density and homogeneity. According to a typical composition, for example, about 3% by weight of elementary sulphur will be

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mixed with vaseline and lanoline in equal percentages. Deodorizing properties can also be conferred upon swathing strips and elastic bandages in accordance with one of the above-described methods for fixing the active principle to  
5 textile materials.

In any case, the specific application procedures underlying the preferred embodiments must not be understood as characteristics that limit the invention. In its most general expression, indeed, the invention resides  
10 in having identified an active principle capable of inhibiting the proliferation of the fungus that generates the bad smell of the feet, eliminating it completely even when the feet remain enclosed in shoes for the whole of a day, without any undesired effects for the wearer as far  
15 as intolerance or allergic reactions are concerned. It should also be noted that the active principle in question, apart from being inert, does not interact with the sebaceous secretion and is therefore absolutely tolerable from a hygienic and sanitary point of view.

20 The protective scope of the present invention thus comprises any use of elementary sulphur for the deodorization of the feet, while variants and/or modifications can be brought to the procedures of its application to such textile products as yarns, cloths of  
25 various compositions, stocking, socks and the like, footwear products, as also in the sanitary sector, without thereby departing from the said scope.